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by

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# NEW ADVANCES IN 1341.4nm Nd:YAP LASERS

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**Abstract: New results of 1341.4nm CW laser and pulsed laser have been reported in this paper. Using Nd:YAP rod of $\phi 8\times 138$mm and $\phi 6.1\times 100$mm, at 195.8W CW radiation and 5.1J pulsed radiation at 1341.4nm have been obtained with efficiencies of 1.43% and 2.02% respectively.**

Key words: 1341.4nm Nd:YAP laser, high CW power, high pulse energy.

## I. Foreword

Exciting emission cross section and fluorescence lifetime are important parameters of laser crystals. Their multiplication product is directly related to threshold value and output. Utilizing the relationship between laser parameters and laser relaxation oscillation frequency, the authors measured the cross section [1] of the $^4F_{3/2}$-$^4I_{13/2}$ jump $Nd^{3+}$ ions in a YAP crystal; the cross sectional area at $2.2\times10^{-19}$ cm$^2$·s is larger than that of the above-mentioned neodymium laser crystal. Hence, the Nd:YAP crystal is currently the 1300nm wave band laser with the best performance.

## II. Experiments and Results

By using an Nd:YAP laser, the authors developed 1341.4nm

continuous and pulsed laser devices. Since the cross sectional area of the $R_1$-$Y_3$ jump in $^4F_{3/2}$-$^4I_{11/2}$ is about double the area [1, 3] of the cross-sectional area [1,3] of the $R_2$-$X_3$ jump in $^4F_{3/2}$-$^4I_{13/2}$, the 1079.5nm laser generated by the $R_1$-$Y_3$ jump should be restrained. The authors utilized a wholly reflected mirror with 96% transmissibility to 1079.5nm and 99.5% reflective index to 1341.4nm, and an output lens with 93% reflective index to restrain 1079.5nm high-power laser light [4].

In the experiment with the continuous wave laser, an $Nd^{3+}$-doped 1at% YAP rod, 8mm in diameter and 138mm in length, was pumped with two xenon lamps, 8mm diameter and 150mm in polar spacing, in a gold-coated dual elliptical-surface light-focusing cavity. Coated with the above-mentioned reflective film, the medium mirror was a plane mirror.

By using the threshold value method, the single-path wear of the two Nd:YAP rods was measured (refer to Fig. 1). Their wear values were 0.48% and 0.57%, respectively.

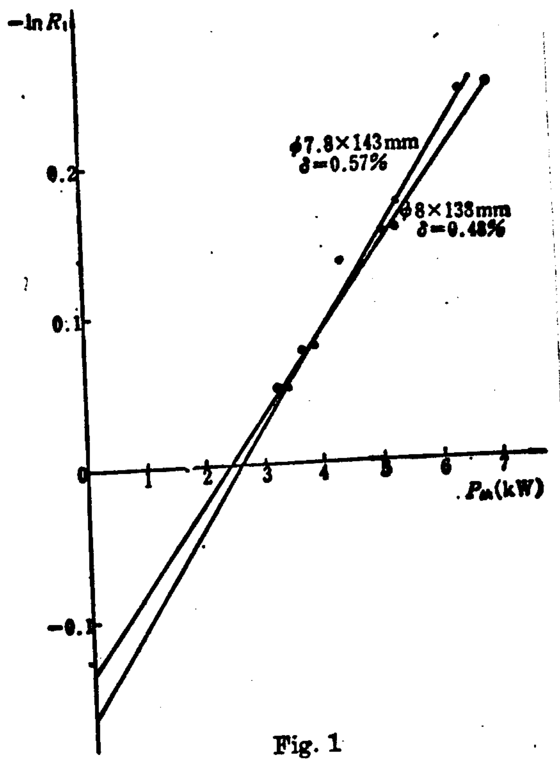


Fig. 1

Fig. 2 shows an output curve of the continuous wave laser; from the figure, the threshold value is 3310W; the maximum output power is 195.8W; the spot efficiency is 1.43%; the inclination efficiency is 2.7%.

When the output power was 160W, the instability of output power was measured. Within 35min of continuous operation, the instability of output power was 1.19%.

In the pulse experiment, the doped 1at% YAP rod, 6.1mm in diameter and 100mm in length, was pumped with an xenon lamp which was 6mm in diameter and 100mm in polar spacing in a silver-coated single elliptical surface light-focusing cavity; the repetition frequency rate was 1pps; the pulse duration of the lamp light was 200microseconds. The transmissibility was 70% for 1341.4nm; and the transmissibility was 91% for 1079.5nm.

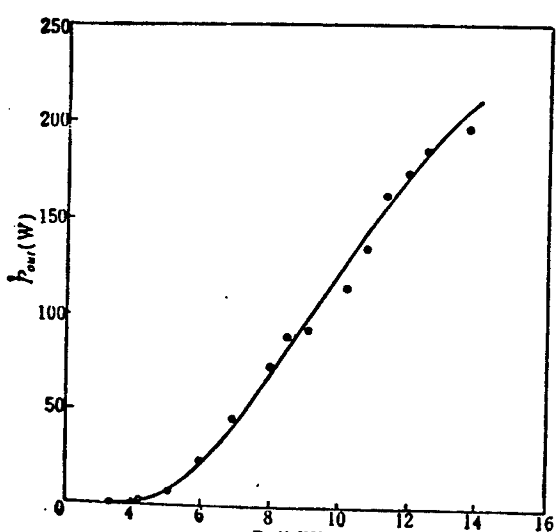

Fig. 2

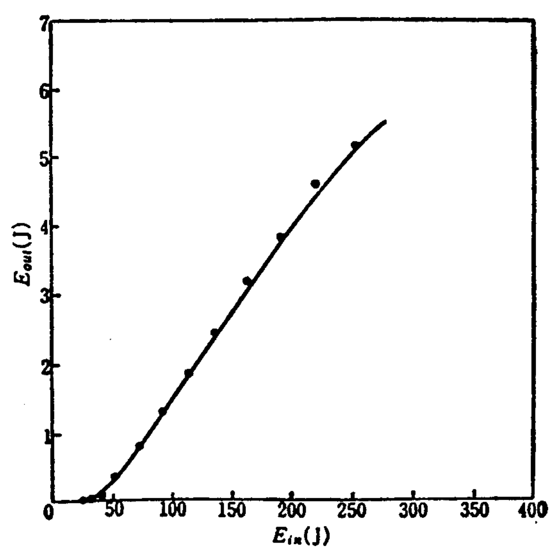

Fig. 3

Fig. 3 shows an output curve of the pulsed laser. From the figure, the threshold value was 30.4J; the maximum output energy is 5.1J; the spot efficiency was 2.0%; and the inclination efficiency was 2.63%.

At the above-mentioned wavelength of the laser, conversion materials can be applied. Determined with nonlinear crystal double-frequency and model 44W plane grating monochromator, the laser light was a singlet radiation at 1341.4nm.

The above-mentioned results further prove the authors' conclusion in reference [4] that the 1300nm wave band Nd:YAP laser device is better than the Nd:YAG laser device.

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